

Technical University of Denmark



Evidence for temporal and spatial variations in groundwater contaminant plume discharge to a stream

Lemaire, Grégory Guillaume; Schulz, Hanna; McKnight, Ursula S.; Bjerg, Poul Løgstrup

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Lemaire, G. G., Schulz, H., McKnight, U. S., & Bjerg, P. L. (2017). Evidence for temporal and spatial variations in groundwater contaminant plume discharge to a stream. Abstract from Globaqua workshop 2017, Barcelona, Spain.

DTU Library

Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Evidence for temporal and spatial variations in groundwater contaminant plume discharge to a stream

Gregory Lemaire¹, Hanna Schulz¹, Ursula S. McKnight¹, Poul L. Bjerg¹

¹ Department of Environmental Engineering, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark

The pollution and impairment of stream waters by chemical compounds is one of the threats currently targeted by the enforcement of the European Water Framework Directive in Denmark. The groundwater/surface water interaction is one of the pathways for the release of contaminants in streams. In this study, a 2D advection-dispersion model associated to field measurements was used to investigate the mixing and dilution of pollutants discharging from a groundwater plume to a stream at different times of the year. The model is a continuation of the work by Aisopou et al. (2015) which simulates the mixing of groundwater pollutant plumes seeping into a stream. Extra features such as drains or sewers can also be accounted for as additional point sources in the adapted model presented here, as well as the dilution effect of tributaries to better simulate the possible urbanization of streams. The model was used to characterize a plume of chlorinated compounds that discharges into a small stream at a former industrial site in Raadvad, Denmark (Average stream width: 10 m; average flow: 300 l/s; contaminant mass discharge: ca. 1 kg/y). The simulation was combined with streambed and surface water sampling, as well as monthly flow rate monitoring and groundwater fluxes. The use of the model facilitated the identification of a possible discharge area of the groundwater plume and successfully captured the evolution of the pollutant concentration and mixing. At the time of measurement, the groundwater plume seeped mostly through a narrow area of the streambed, which was confirmed by high concentration results from the streambed water sampling and identification of an upward groundwater flux into the stream. The measurements and simulations carried out at later times of the year revealed the existence of temporal and spatial variations: 1) in the overall quantity of chlorinated compound discharged, 2) in the discharge pathways with additional contribution from a drain, and 3) in the contaminant mixing itself. The results highlight the complexity and variability of the contaminant fluxes at the interface between a groundwater contaminated plume and stream water, and the need for a better understanding of the general dynamics of these fluxes.

Acknowledgements

Some of the measurement data were acquired by the company Orbicon A/S, for which the authors are thankful for.

References

Aisopou, A., Bjerg, P. L., Sonne, A. T., Balbarini, N., Rosenberg, L., and Binning, P. J. *Dilution and volatilization of groundwater contaminant discharges in streams*. Journal of Contaminant Hydrology (2015), 172, p.71-83.